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**A U S T R A L I A**  
**Patents Act 1990**

**PROVISIONAL SPECIFICATION**

for the invention entitled:

**"Glass Handling Systems"**

The invention is described in the following statement:

## GLASS HANDLING SYSTEMS

The present invention relates to systems for handling sheets of glass or other sheets of relatively rigid and relatively smooth material such as metal, marble, or plasterboard.

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To manually manoeuvre relatively large sheets of glass or metal a grip device may be temporarily applied to the surface of the sheet to provide a hand grip or hand hold by which the sheet can be held. US patent 3,240,525 discloses a vacuum grip having a handle and a gripping pad which can be attached to the surface of the sheet by a small hand-  
 10 operated vacuum pump whereby the grip can be securely attached to the surface of the sheet by a vacuum effect without damaging the surface of the sheet. Vacuum grips of the type shown in US 3,240,525 have been commercially available for many years and are in common use to facilitate manual transportation and manoeuvring of relatively large sheets of glass and the like in factories, in workshops, and by trades people such as glaziers and  
 15 shop fitters. Typically, for use with larger sheets of glass, two or perhaps more, of the vacuum grips are applied to the surface of the sheet to enable the sheet to be manoeuvred and transported by two or more people, and when the sheet is in the required position the grips are removed from the sheet simply by releasing the vacuum.

20 Although grips such as those just described are a significant aid to handling large sheets of glass and the like, nevertheless due to the weight of the glass sheet and sometimes the physical size of the sheet, strain injuries can often arise to personnel. A particular problem can also arise when manipulating a large sheet of glass for accurate placement into a frame such as may be incorporated in a shop front or similar.

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According to the present invention, there is provided a device for handling glass or other sheet material, said device being in the form of a wheeled trolley and having at least one vacuum grip for releasable attachment to the surface of the sheet to thereby support the sheet from the trolley, said trolley having at least one ground engaging wheel, and means  
 30 enabling the height of the vacuum grip relative to the wheel to be adjusted.

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In one preferred form, the vacuum grip comprises a vacuum gripping pad associated with a vacuum pump which can be operated to apply a vacuum.

In a preferred embodiment of the invention, the trolley comprises a main support shaft  
 5 which extends upright in use of the trolley and the vacuum grip is mounted for movement  
 into a selected position along the length of the shaft with means to secure the grip in a  
 selected position. Particularly advantageously, the shaft is threaded and the vacuum grip  
 includes threaded structure for engagement with the thread of the shaft. Preferably the  
 threaded structure is in the form of a split nut which can be released from engagement with  
 10 the shaft thread to thereby enable the vacuum grip to be displaced along the shaft to a  
 selected position at which the split nut is re-engaged.

Particularly advantageously the device also includes means for rotating the shaft whereby  
 when the threaded structure is engaged with the shaft and the vacuum grip is coupled to the  
 15 sheet, rotation of the shaft will raise or lower the sheet relative to the ground to thereby  
 permit relatively fine adjustment in the height of the sheet to facilitate placement.

Particularly advantageously, the shaft carries two or more such vacuum grips for  
 engagement with the sheet.

20

A system for handling relatively large sheets will involve the use of at least two trolleys as  
 defined above. For this purpose it is particularly convenient for each trolley to have a  
 single ground-engaging wheel at the lower end of the main supporting shaft and mounted  
 with a caster action.

25

In alternative forms the trolley may have wheels mounted in tandem fashion so that use of  
 a single trolley on smaller sheets will itself provide stable support.

Embodiments of the invention will now be described by way of example with reference to  
 30 the accompanying drawings in which:

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Figure 1 is a schematic view showing a sheet handling system involving the use of two wheeled trolleys in accordance with a preferred embodiment of the invention;

Figure 2 shows schematically a detail "A" of the trolleys of Figure 1 to show a vacuum grip and its relationship with a main support shaft;

5 Figure 3 is an exploded view corresponding to Figure 2;

Figure 4 is a front view corresponding to Figure 2;

Figure 5 is a side view corresponding to Figure 2;

Figure 6 is a schematic sectional view to illustrate internal structure of the body of the vacuum grip;

10 Figure 7 is a fragmentary view showing an actuating handle and associated structure of a ratchet system for rotating the main support shaft; and

Figure 8 is an exploded view corresponding to Figure 7.

Figure 1 of the drawings shows a glass handling system in accordance with the preferred  
15 embodiment of the invention. The handling system comprises two wheeled trolleys 2 to which a sheet 4 of glass is attached so that the sheet can easily be transported and manoeuvred. Effectively therefore the sheet 4 can be wheeled along the ground without causing undue strain to the personnel concerned. Each of the trolleys 2 is identical and the construction of the trolley will now be described.

20

The trolley 2 consists of a single support shaft 6 which is upright during use. The lower end of the shaft 6 carries a single wheel 8 which is preferably supported from the shaft with a caster action. Although it would be possible for the trolley 2 to have more than one wheel at the lower end of the support shaft 6, for example two wheels arranged side by  
25 side or in tandem, in the embodiment illustrated in which the trolley 2 is principally intended to be used in conjunction with other identical trolleys in the manner shown in Figure 1, a single wheel with a caster action is preferred as this permits particular ease of manoeuvrability. The support shaft 6 carries two vacuum grips 10 at upper and lower positions along its length to permit secure, but releasable, attachment to the sheet 4. It is to  
30 be noted that although the embodiment illustrated has the two vacuum grips 10, the invention is not restricted to the use of two grips; depending on particular requirements, the

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trolley may be designed with only a single vacuum grip or more than two vacuum grips. The basic construction and operation of the vacuum grip 10 including a vacuum pump 12 with a vacuum release facility is preferably as disclosed in US patent 3,240,525 to which reference may be made particularly for an understanding of preferred aspects of the design of a gripping pad 14 and associated structure. The vacuum grip 10 used in the preferred embodiment of the invention differs from that shown in the US patent principally in the design of its main body by which it is attached to the support shaft 6 and that will now be described in detail.

10 As shown, the main body 15 of the grip 10 and to which the vacuum gripping pad 14 and associated structure is attached is of block-like form having a vertical passage 16 through which the shaft 6 extends. The shaft 6 is externally threaded and the body 15 houses a split nut 18 which is normally engaged with the thread of the shaft. It is to be noted that the shaft 6 is threaded over substantially its entire length, although in these drawings which are only schematic drawings the thread is for clarity of illustration only indicated on part of the shaft. The body 15 carries a spring-loaded release system which operates under spring bias to maintain the two halves 18a, 18b of the split nut 18 in engagement with the thread of the shaft 6. The release system is manually actuatable to move the two halves of the nut 18 apart out of engagement with the thread, and in this disengaged position the vacuum grip 10 is able to be quickly displaced along the shaft into a selected position for use, whereon the vacuum grip 10 can be retained in that position by re-engagement of the two halves of the split nut 18 with the thread.

The release system comprises a release lever 20 mounted for pivotal movement on a pivot pin 22 extending parallel to the shaft 6. A first horizontal pin 24 extends at one side of the pivot pin 22 to the adjacent, inner, half nut 18b for threaded engagement therewith. A second horizontal pin 26 at the other side of the pivot pin 22 extends through a passage in the adjacent half nut 18b into threaded engagement with the other, outer, half nut 18a; this is best seen in Figure 6. The outer half nut 18a is subject to the action of a compression spring 30 which displaces that half nut in an inwards direction for engagement with the thread. An outer end of the release lever 20 is also subject to the action of a compression

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spring 32 which applies a pivotal bias to the lever 20 in a sense to bias the lever anticlockwise (as viewed in Figure 6) about pivot pin 22 whereby the inner half nut 18b is pushed by the pin 24 inwardly into engagement with the thread and the outer half nut 18a is drawn inwardly, this action reinforcing the action of the spring 30. In this way the two  
5 half nuts 18a, 18b are held firmly, but releasably, in engagement with the thread. In order to release the half nuts 18a, 18b from engagement with the thread and thereby to permit adjustment of the position of the vacuum grip 10 along the shaft 6, the release lever 20 is displaced clockwise (as viewed in Figure 6) against the bias of the spring 32. In the embodiment shown, this actuation of the release lever 20 to release the half nuts 18a, 18b  
10 is effected by depressing a button 34 incorporated in a side wall of the main body 15.

The main body 15 also includes an outer handle 36 by which the vacuum grip 10 can be held for displacement along the shaft 6. Conveniently, the release button 34 is aligned with the axis of the handle 36 and is at one end thereof so that the handle 36 may be  
15 gripped with one hand with the thumb of that hand depressing the release button 34 to permit the movement of the vacuum grip 10 along the shaft 6.

Although the release mechanism just described is particularly convenient, it will be understood that other mechanisms which effect temporary release of the half nuts from the  
20 thread can alternatively be used.

The system just describes a quick-action coarse adjustment of the position of the vacuum grip 10 along the shaft 6 to suit a particular application and, for many applications, this type of adjustment will be adequate so that the trolley can readily be adjusted to suit the  
25 size of glass sheet being handled and also the height at which the glass sheet is held above the ground. However, for applications such as shop fitting when it is necessary for the glass sheet to be manoeuvred into substantially precise alignment with a frame for fitting into the frame, a further, fine, adjustment system is provided. In the embodiment shown, this fine adjustment is provided by rotating the shaft 6 while the vacuum grips 10 are  
30 attached to the sheet with their split nuts 18 engaged with the thread of the shaft 6 whereby rotation of the shaft 6 in a selected direction will cause the vacuum grips 10 associated

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- with the shaft 6 and hence the sheet carried thereby, to move upwardly or downwardly. In the embodiment shown where two trolleys 2 are used to carry the sheet of glass it will be appreciated that by selective rotation of each of the two shafts 6 the sheet of glass can be accurately positioned at a height such that it can be "pushed" on the trolleys 2 into the support frame in exact alignment with the opening of the frame. Although the degree of adjustment which can be achieved in this way is dependent of the thread pitch, even with a relatively coarse thread a relatively fine vertical adjustment can be achieved to provide accurate placement of the glass sheet.
- 5
- 10 Rotation of the shaft 6 to effect this fine adjustment can be effected in any suitable way, for example using a handle linked to the shaft via a suitable gear system. In the particular embodiment shown, the shaft 6 is formed with a pinion gear 40 driven by reciprocating movement of a handle 42 via a reversible pawl 44 so that by appropriate setting of the pawl 44 the pinion gear 40 is driven by a ratchet action in a selected direction by operation of
- 15 the handle 42, and thus the shaft 6 can be driven in a direction either to raise or lower the position of the vacuum grips 10, as required. A lever for setting the driving direction of the pawl 44 is shown at 46. It will be seen that the ratchet handle 42 projects substantially horizontally to facilitate easy access. In alternative arrangements, the shaft 6 can be rotated via a bevel-gear system using a handle located at the front of the trolley (ie the side
- 20 remote from the glass) with the handle being rotatable in either direction in order to raise and lower the vacuum grips 10.

Although a fine adjustment system provided by rotation of the shaft is particularly preferred, nevertheless for some applications where fine adjustment in the positioning of the sheet carried by the trolley is not required, this facility could be omitted.

25

The trolley 2 of the preferred embodiment is specifically designed for use with at least one other trolley to jointly carry a sheet in the manner illustrated in Figure 1 and trolleys of this form are suitable for use with a wide range of sizes of sheet. A trolley having applicability just to smaller sizes of sheet can be of similar construction to that just described but with the lower end of the shaft 6 coupled to a chassis or beam carrying two or more wheels in

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tandem relation to provide a stable support for the sheet when the trolley is positioned approximately midway along the length of the sheet. Depending on the size of the trolley it may be necessary to incorporate bracing between the shaft and chassis/beam to ensure the structural integrity of the trolley.

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Although the invention has been particularly described in relation to the handling of glass sheets, it is to be understood that the trolleys as described are equally applicable to handling other relatively heavy rigid sheet material such as metal sheet, marble, or plasterboard.

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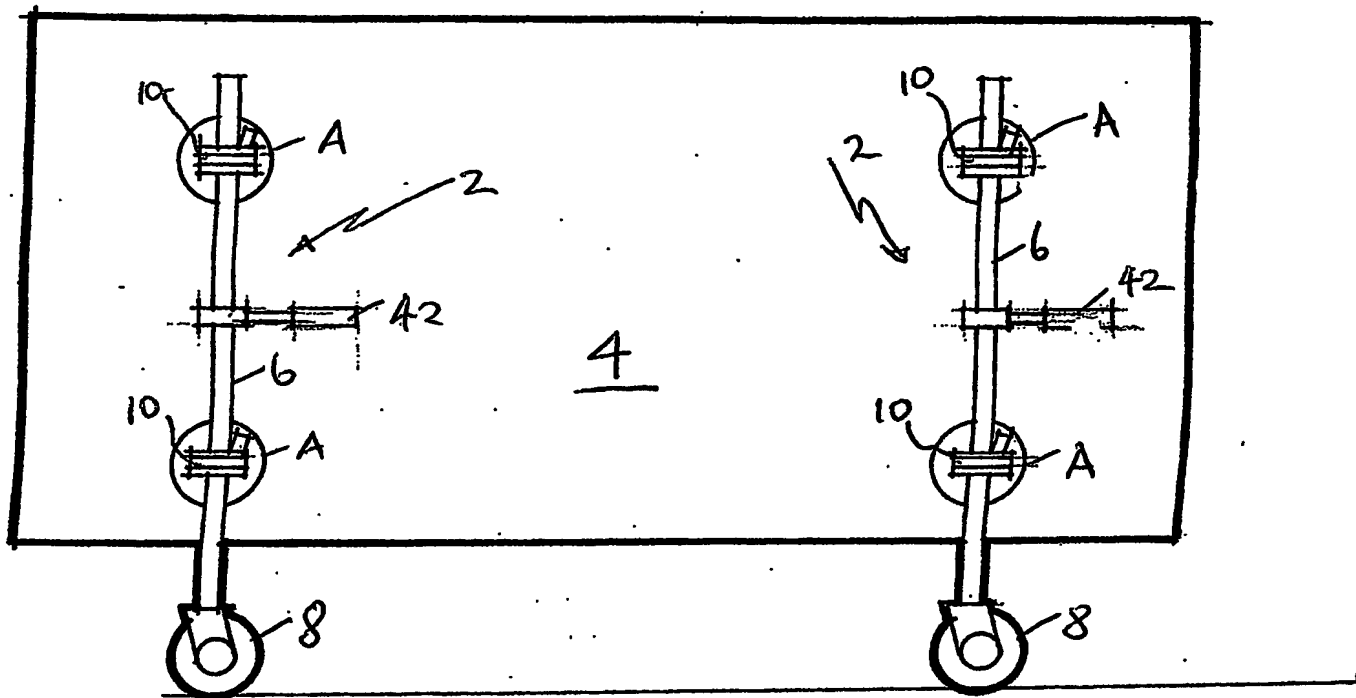
The embodiments have been described by way of example only and modifications are possible within the scope of the invention.

DATED this 9<sup>th</sup> day of July 2002

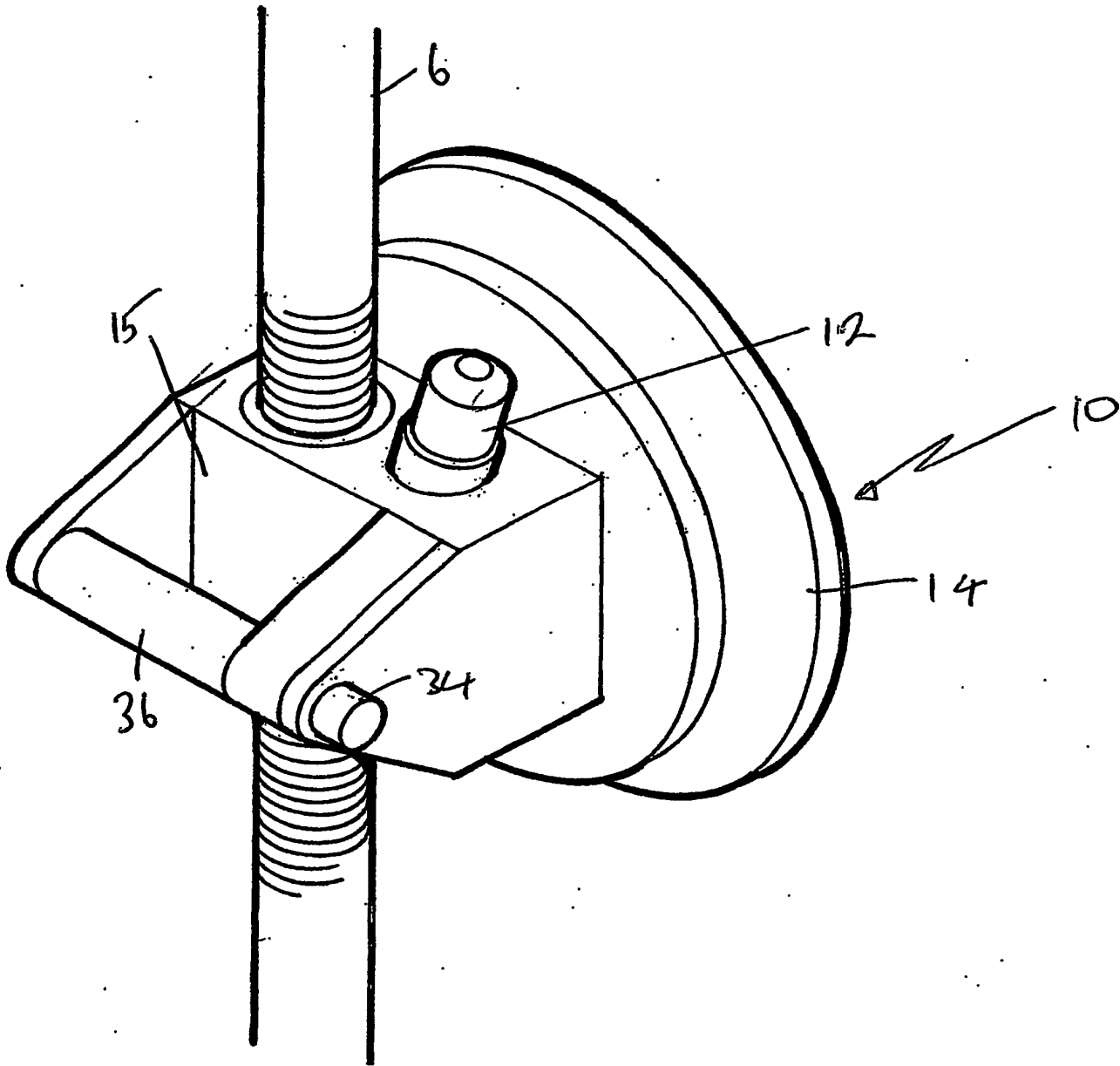
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By DAVIES COLLISON CAVE

Patent Attorneys for the applicant



**FIGURE 1**



**FIGURE 2**



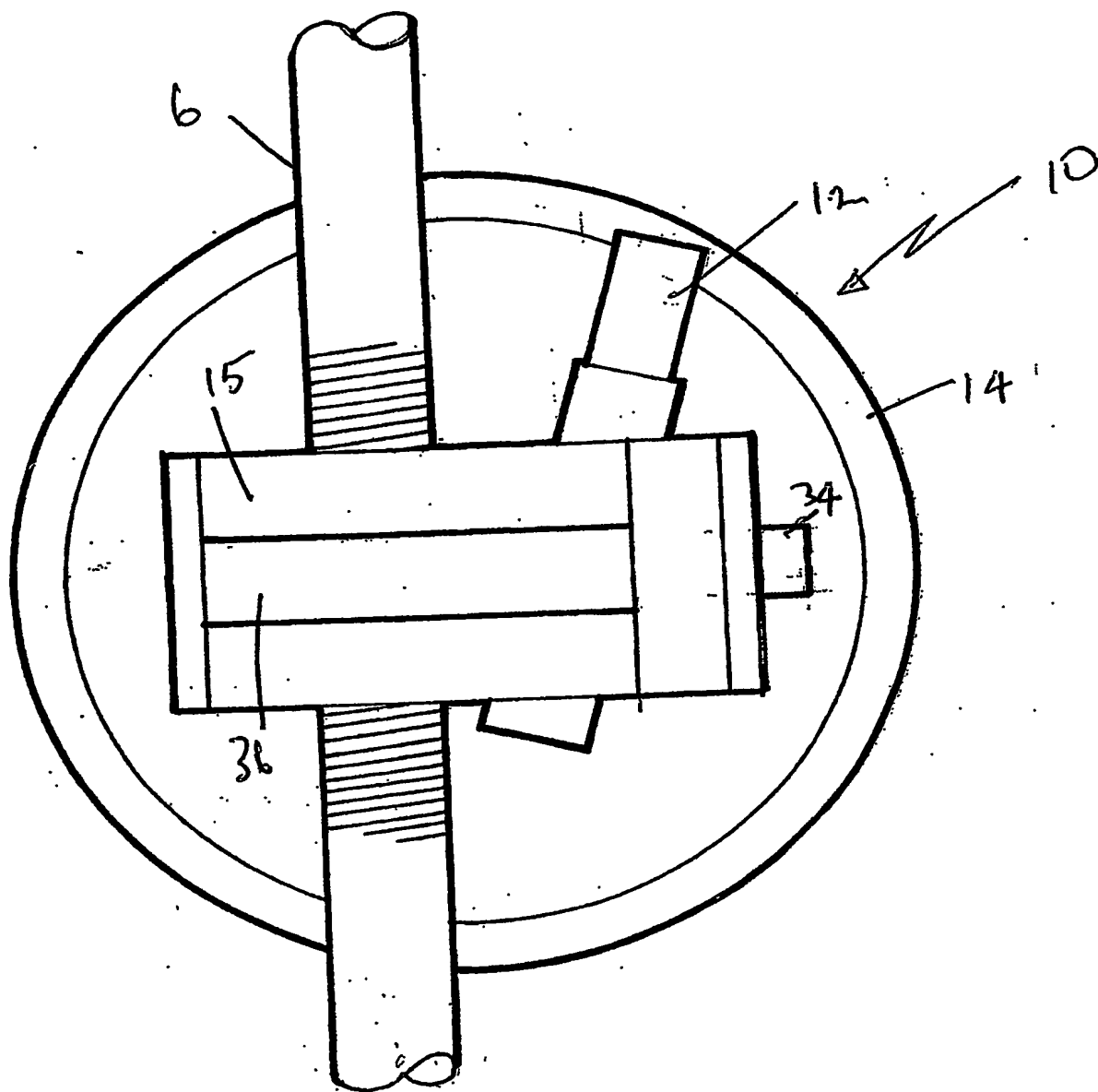


FIGURE 4

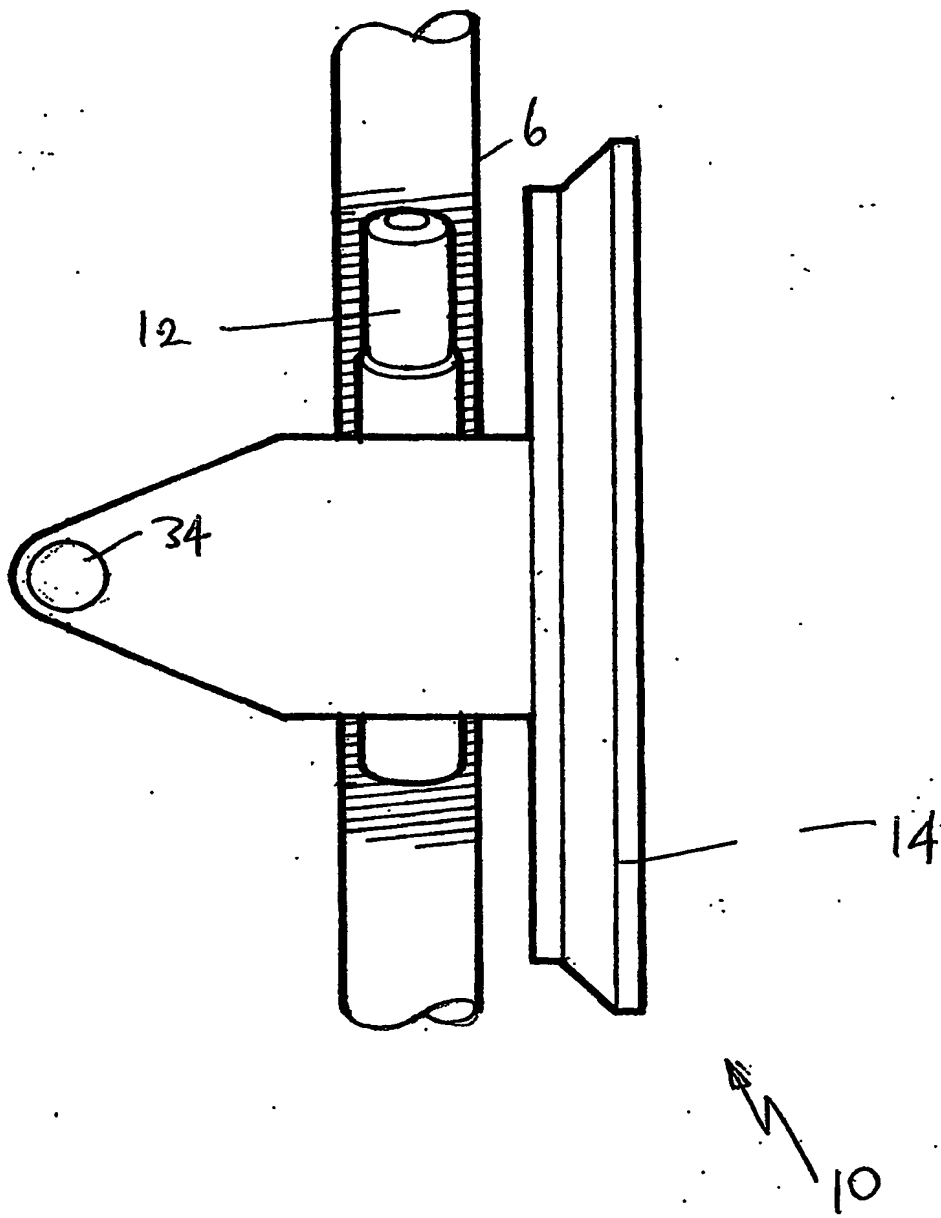


FIGURE 5

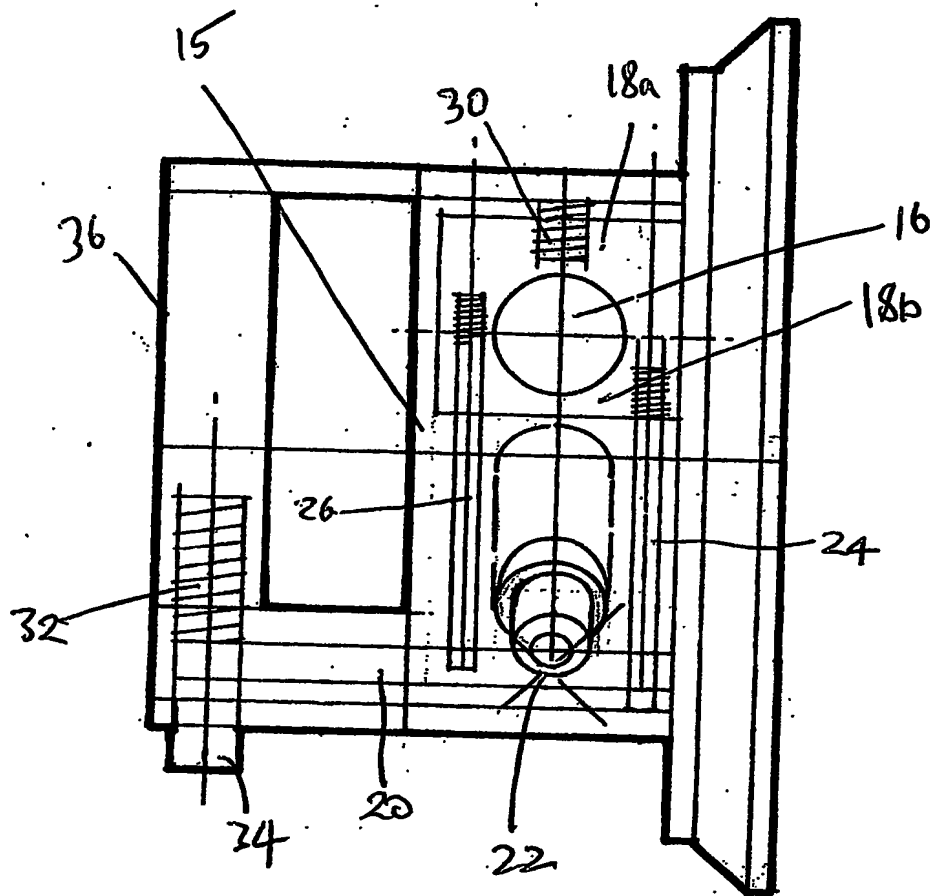


FIGURE 6

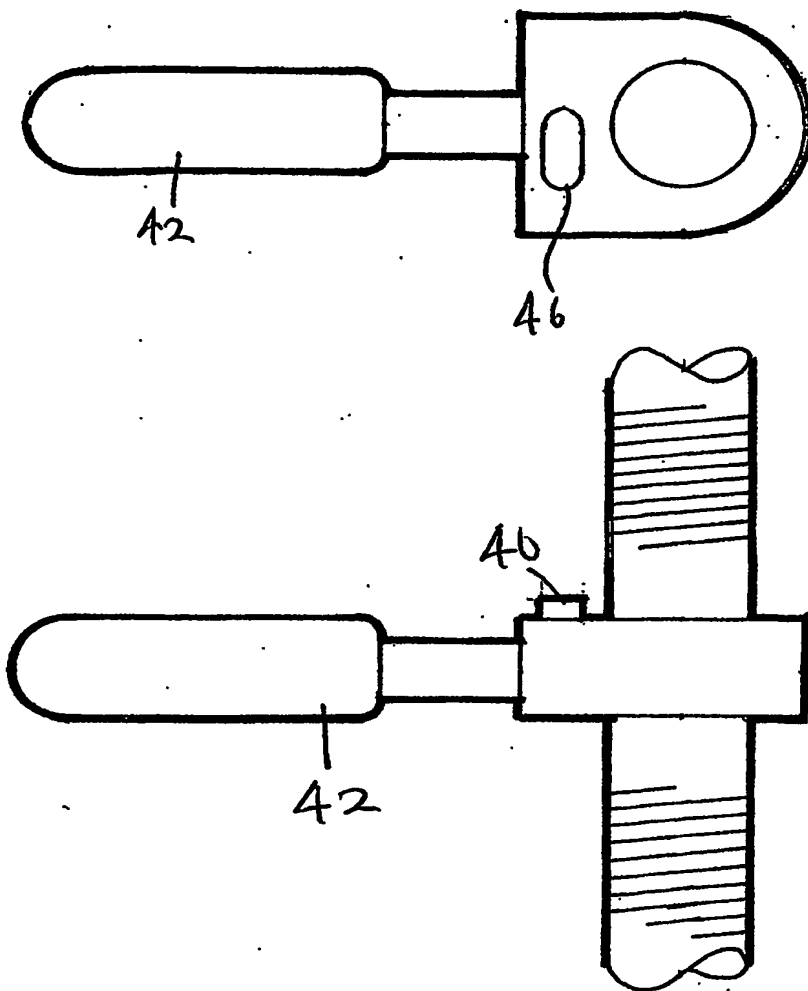
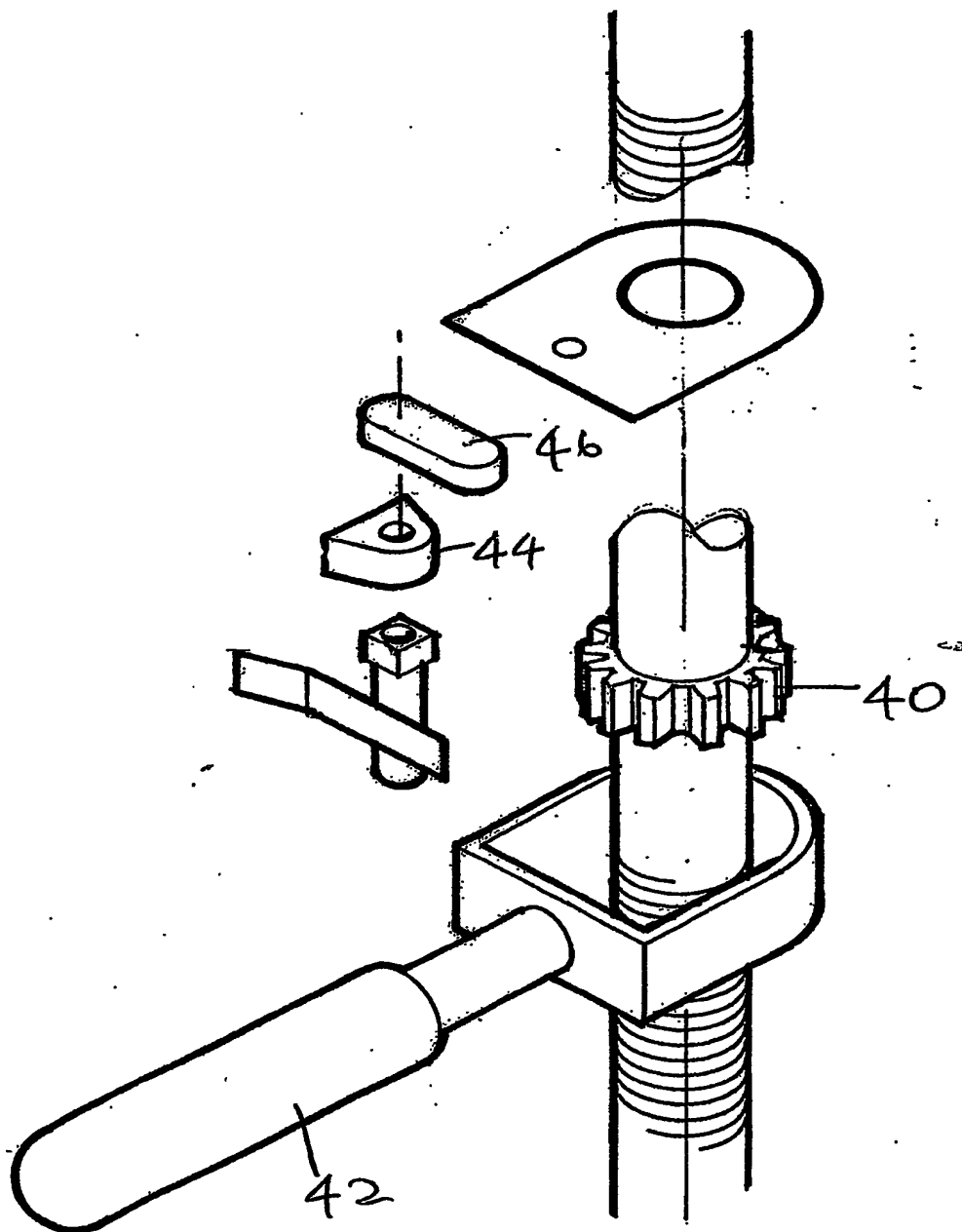


FIGURE 7





**FIGURE 8**

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